



Assessment of Knowledge, Practices, and Attitude among Poultry Sellers on Antimicrobial Use in Mjini Magharibi Region, Zanzibar

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Abstract

Introduction: The use of antimicrobials in animal production, particularly for disease prevention, poses health risks due to potential residues in animal products and the development of antimicrobial resistance. In Zanzibar, where agriculture contributes significantly to the GDP, poultry is a predominant livestock industry, but faces challenges in meeting local market demand. Poultry production deficits are addressed largely through the importation of poultry meat from abroad, highlighting the importance of addressing antimicrobial use and residues in the poultry supply chain to safeguard public health and food safety.

Method: A cross-sectional KAP study was conducted from January to December 2023 among 55 poultry sellers in Mjini Magharibi district in Zanzibar using a semi-structured questionnaire. Data were captured and analyzed using Microsoft Excel and IBM SPSS version 22 software. A 95% confidence interval with a p-value of less than 0.05 was considered statistically significant for knowledge, attitude and practices. **Results:** Out of 55 poultry sellers, 49 (89.09%) were not knowledgeable on antimicrobial use and antimicrobial residues and practices, and 43 (78.18%) had considerable appropriate knowledge of AMU and AMR. Likewise, 34 (61.82%) sellers had a positive attitude towards the AMU and AMR. The correlation was good ($r = 0.654$) between knowledge-practices scores but weak ($r = 0.077$) between knowledge-attitude scores. Knowledge, attitude and practices were not significantly affected by the educational level of the respondents. **Conclusion:** In Zanzibar, the study reported poor knowledge of the poultry sellers related to the use of antimicrobials and resistance. Participants had low regard for the risk posed by antimicrobial

resistance and, in general, poor practices, such as not following prescriptions and the observance of withdrawal periods. Targeted, urgent interventions need to be instituted including the provision of education on Antimicrobial Use (AMU) and the risk of Antimicrobial Residues (AMR), the need to observe the withdrawal period, poultry handling and waste management and environmental sanitation.

Subject Areas

Health Policy, Public Health, Veterinary Medicine

Keywords

Antimicrobial Use, Antimicrobial Resistance, Withdrawal Period, Antimicrobial Residues

1. Background Information

Antimicrobials are synthetic medicines used for treating various microbial diseases in both humans and animals. In the animal industry, farmers use antimicrobials mainly for the prevention and treatment of diseases in food animals and for growth promotion. The use of antimicrobials in animal production is estimated to be about four times higher than the use of antimicrobials in humans [1]. Various antimicrobials have made significant contribution in prevention, control and treatment of infectious diseases in animals since 1940s [2]. Frequent use of antimicrobials in animal production systems may lead to residues in food of animal origin and create some serious health problems such as allergic reactions, antimicrobial resistance (AMR), carcinogenic and mutagenic effects in the human body [3]. The potential threat to human health resulting from inappropriate antibiotic use in food animals is significant, as pathogenic resistant organisms propagated in these livestock are poised to enter the food supply and could be widely disseminated in the food chain [4].

According to the Tanzania Livestock Master Plan of 2017/2018 - 2021/2022, in Tanzania, Agriculture contributes 30% of the total Gross Domestic Product (GDP), where 50% of households keep livestock, with chickens contributing 86% of the livestock or households [5]. The most used antibiotics in poultry production in Tanzania include sulphonamides, followed by tetracycline, macrolides and fluoroquinolones [6]. Studies in Tanzania have also shown that many farmers use tetracycline and its variants to treat and prevent diseases but with poor awareness of the antimicrobial residues in the foods from their production practices [7].

The performance of the poultry sub-sector in Zanzibar, which is mainly practiced in urban and peri-urban areas, is constrained by numerous challenges such as diseases and poor practices [8]. The 2019/2020 National Sample Census of Agriculture reports the uneven distribution of the chicken population in Zanzibar with Kusini Unguja leading both with the highest number of chickens (1.9 million)

which is 50.7% and layers (1,696,341 layers, 80.1%) whereas Mjini Magharibi region has the largest population of broilers, which is 96.8% of all broilers kept in the island.

Poultry farmers feed antimicrobials to their birds as part of the routine to prevent diseases and infections and for growth promotion [9] but so little is known about the knowledge, attitude and practices of the poultry sellers after attaining the birds. This study aimed to assess knowledge, attitude, and practices regarding antimicrobial use among poultry sellers in Mjini Magharibi District, Zanzibar. The outcomes of this research are also anticipated to be beneficial to the animal health and public health authorities in Zanzibar as they will help inform policy on good poultry husbandry practices and future research.

2. Research Objectives

- 1) To assess the knowledge, practices, and attitudes among poultry sellers on antimicrobial use at Mwanakwerekwe market in Unguja, Zanzibar.
- 2) To assess the knowledge, practices, and attitudes among poultry sellers on antimicrobial use at Darajani market in Unguja, Zanzibar.

3. Research Methods

The research method was carried out following intuitive and vivid steps to obtain the data, process and analyze to get the results. This is illustrated in **Figure 1** below.

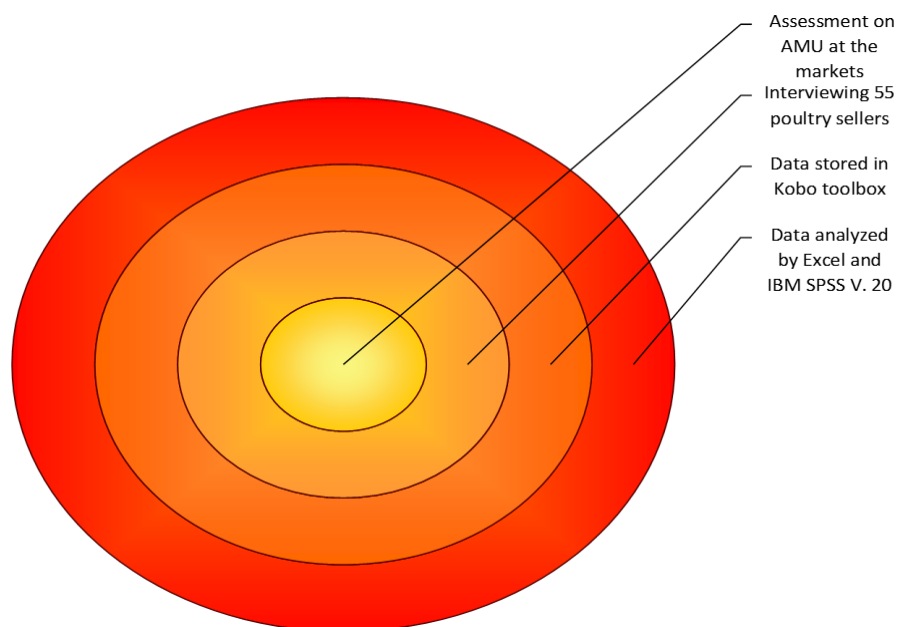


Figure 1. A sketch showing how the methodology was used to obtain the core results.

3.1. Study Area

The study was conducted in Mjini Magharibi Region in Unguja, Zanzibar at

Mwanakwerekwe and Darajani Markets. The two markets serve as the main source of food products for the people at Mjini Magharibi region with ranging seasonal variability in the consumers.

3.2. Study Design and Sample Size

This cross-sectional study was conducted for two months, from January to February 2023, where 55 poultry sellers' from Mwanakwerekwe and Darajani Markets were interviewed through face-to-face interviews using a pretested, modified questionnaire. The sellers were obtained at the markets and interviewed voluntarily by asking their consent to participate. The individuals who declined to be interviewed were not included in the data collection process, each of the consented poultry seller was given a pre-tested, structured questionnaire designed to assess their knowledge, attitude and practices on antimicrobial use (AMU) and antimicrobial resistance (AMR). The questionnaire was developed in English and then translated and administered in Kiswahili, to which all respondents had good proficiency.

3.3. Data Management

The questionnaire was stored online using a Kobo Toolbox an open-source software with a free-of-charge server that provides online storage (<https://www.kobotoolbox.org>). The data were then exported into Microsoft Excel and IBM SPSS version 22 software for cleaning and analysis.

3.4. Statistical Analysis

Descriptive statistical analyses were performed using Microsoft Excel and IBM SPSS version 22 software was used for testing correlation coefficients of the independent variables of the participants, age, sex, marital status and business experience against their dependent variables of knowledge, attitude and practices. Proportions of knowledge levels, attitudes, and practices among the participants were analyzed using descriptive statistics, to compare multiple means between the distribution of knowledge levels, attitude and practices, together with Pearson's correlation test was used. All levels of significance were set at $p < 0.05$.

4. Results

4.1. Socio-Demographic Characteristics of the Respondents

The study revealed that the respondents were all male, signifying that the poultry-selling business at Mwanakwerekwe and Darajani markets is male-dominated. Many respondents were of ≤ 35 age group which accounted for 14 (24.5%). Majority 21 (38.2%) of the respondents had at least a primary school education, followed by secondary school education who accounted for 20 (36.4%), and only 4 (07.3%) of the sellers reached tertiary/college level while 10 (18.2%) of the sellers never attended school Business experience varied from those with less than 1-year experience in the business 3 (5.5%), those with 1-2 years of experience 16 (29.1%),

10 (18.2%), with 3-4 years of experience, and those with over 5 years of experience were 26 (47.3%). The majority of the sellers 35 (63.6%) sell both live birds and broiler meat, and the majority of the sellers 24 (43.6%) purchase stocks with a range volume of 201 - 300 kg as illustrated well in **Table 1** below.

Table 1. Socio-demographic status of the respondents.

Variable	Number	Percentage
Age		
<35	14	24.5
36 - 40	09	16.4
41 - 45	12	21.2
46 - 50	11	20.6
>50	09	16.4
Sex		
Male	55	100
Female	0	0
Marital status		
Married	41	74.6
Single	14	25.5
Education level		
Primary education	21	38.2
Secondary education	20	36.4
Tertiary/college	04	07.3
Never attended	10	18.2
Business period (in years)		
Below 1	03	05.5
Between 1 - 2	16	29.1
Between 3 - 4	10	18.2
Above 5	26	47.3
Type of broiler you purchase		
Live bird	18	32.7
Broiler meat	02	03.6
Both (live bird and broiler meat)	35	63.6
Amount of stock purchased from supplier		
0 – 50 kg	03	05.5
51 – 100 kg	13	23.6
101 – 200 kg	12	21.8
201 – 300 kg	24	43.6
301 kg and above	03	05.5

4.2. Knowledge of Participants on Antimicrobial Use and Residues

The assessment of participants' knowledge in the poultry industry revealed notable gaps in understanding key concepts of AMU and AMR as shown in **Table 2** below. Only 6 (10.9%) of the sellers demonstrated awareness of antimicrobial residues, while an overwhelming majority 49 (89.1%) lacked this knowledge. Similarly, 52 (94.6%) were not aware of the effects of antimicrobial residues. 13 (23.6%) were aware of tetracycline as an antibiotic and also were aware of the uses of tetracycline in poultry. Antimicrobial resistance was not known by the majority of the participants 47 (85.5%).

Table 2. Knowledge about antimicrobial use of the studied population.

Variable	Yes (n, %)	No (n, %)
Do you know about antimicrobial residues	6 (10.9%)*	49 (89.1%)
Are you aware of the effects of antimicrobial residues	3 (5.5%)*	52 (94.6)
Do you know about antimicrobials	13 (23.6%)*	42 (76.5%)
Do you know about Tetracycline	13 (23.6%)*	42 (76.5%)
Do you know that tetracycline is used in poultry	13 (23.6%)*	42 (76.5%)
Do you know about tetracycline residues in poultry meat	7 (12.7%)*	48 (87.3%)
Do you know that tetracycline residues cause health consequences in poultry meat consumers	7 (12.7%)*	48 (87.3%)
Do you know about withdrawal period	19 (34.6%)*	36 (65.5%)
Do you know about antimicrobial resistance	8 (14.6%)*	47 (85.5%)
Do you know that presence of antimicrobial residues in the broiler chicken meat could trigger antimicrobial resistance	6 (10.9%)*	49 (89.1%)

*Correct answer.

Coefficients analysis between the independent variables of age, marital status, education level and business experience of the poultry sellers was tested against the dependent variable of knowledge using SPSS version 22 software, with the correlation factor of $p\text{-value} \geq 0.05$. The findings revealed that the age, marital status and education level of the poultry sellers had no significant difference to their knowledge on Antimicrobial Use and Residues with P values of 0.901, 0.187 and 0.835 respectively. While their business experience showed that there is a significant difference of 0.008 P-value, meaning that the business experience of the poultry sellers affected their responses on the knowledge and awareness of antimicrobial use and residues, as shown in **Table 3** below.

Table 3. Coefficients of the variables against knowledge.

Variable	t	Sig.
Age	-0.125	0.901
Marital status	1.337	0.187
Education level	-0.210	0.835
Business period	2.746	0.008

4.3. Practices of Participants in Antimicrobial Use

Findings of the participants' practices on AMU shown in **Table 4**, indicate that 28 (51%) of participants used methods to control and prevent diseases in broiler chickens, 35 (63.6%) of them also employed traditional methods apart from antimicrobial usage in broiler chicken management. Additionally, 42 (76.4%) of participants agreed to treat their broiler chickens with antimicrobials. 14 (25.5%) of the sellers normally enquire about the treatment of bird/broiler meat before they purchase from their suppliers and/or farmers. Moreover, 12 (21.8%) of the sellers reported observing the withdrawal period after the self-treating of their sick birds, and 17 (31%) adhered to prescription instructions prior to giving from veterinary shops to antimicrobials. 9 (16.4%) of participants sold broiler chicks that had just received antibiotic treatment within two weeks. Further, it was revealed that 27(49.1%) of the sellers commonly administer antimicrobials to live broiler chickens through feeds and or feeds, while 7(12.7%) used injections for administration either by themselves (without specific training) or veterinary and animal health practitioners. Lastly, 17(31%) of the participants admitted to utilizing supplements such as vitamins to ensure market weight and quality maintenance such as health in chickens.

Table 4. Practices of respondents regarding antimicrobial use.

Variable	Yes (n, %)	No (n, %)
Do you use any measures to control and prevent diseases to your live broiler chicken	28 (50.9%)	27 (49.1%)
Do you use any other traditional method for broiler chicken management	35 (63.6%)	20 (36.4%)
Do you treat your broiler chicken with antimicrobial	42 (76.4%)	13 (23.6)
Do you enquire on whether the birds/broiler meat you purchase have been under treatment before you buy them?	14 (25.5%)	41 (74.6%)
Do you follow the prescriptions before administering the antimicrobials	17 (30.9%)	38 (69.1%)
Do you wait for withdrawal period after treating your birds?	12 (21.8%)	43 (78.2%)
Do you sell broiler chicken that were recently treated with antimicrobial in less than 2 weeks period	9 (16.4%)	46 (83.6%)
Do you administer the antimicrobials to your live broiler chicken through their feeds	27 (49.1%)	28 (50.9%)
Do you administer the antimicrobials to your live broiler chicken through injections	7 (12.7%)	48 (87.3%)
Do you feed/use any other supplement to your chicken to ensure they maintain market weight and quality	17 (30.9%)	38 (69.1%)

Coefficients analysis of the independent variable of age, sex, marital status and business experience was tested using SPSS version 22 software against the dependent variable of practices with the correlation factor of P value ≥ 0.05 . The findings show that the age, marital status and education level of the poultry sellers had no

significant difference in their practices on Antimicrobial Use with p values of 0.492, 0.192 and 0.264 respectively, while their business period showed significant differences with p value of 0.000, meaning that the business experience of the poultry sellers affected their responses on the practices regarding antimicrobial uses, whereas the seller who has a high business experience could practice better compared to the ones as shown in **Table 5** below.

Table 5. Coefficients of the variables against practices.

Variable	t	Sig.
Age	0.693	0.492
Marital status	1.324	0.192
Education level	1.131	0.264
Business period	4.370	0.000

4.4. Attitude of Participants on Antimicrobial Use and Residues

Results of the attitude of poultry sellers on AMU and residues antimicrobials as presented in **Table 6** indicate that, 46 (83.6%) of sellers expressed willingness to continue using antimicrobials for broiler chicken and only 12 (21.8%) made follow-ups on antimicrobial usage before purchasing. However, 17 (30.9%) of the sellers expressed that they would not recommend excessive antimicrobial use for favorable results, and only 5 (9.1%) advised against buying antimicrobials from any available shops. Concerns about selling recently treated broiler chickens were evident, with 13 (23.6%) willing to do so and 15 (27.3%) believing that broiler chickens with antimicrobial residues could pose health risks to consumers. Additionally, 18 (32.7%) would inform clients if they knew about antimicrobial residues in the chickens, they were selling. The importance of delivering and seeking veterinary services was acknowledged by 49 (89.1%) of the sellers, while 9 (16.4%) recommended the use of broiler chickens recently treated with.

Table 6. Attitude of respondents toward antimicrobial use.

Variable	Yes (n, %)	No (n, %)
Would you encourage the continuation of the use of antimicrobials to broiler chicken	46 (83.6%)*	9 (16.4%)
Do you make follow up on antimicrobial usage to the broiler chicken before purchasing	12 (21.8%)*	43 (78.2%)
Would you recommend excessive use of antimicrobial to broiler chicken to get favorable results	17 (30.9%)	38 (69.1%)*
Would you advice a farmer to buy antimicrobials from just any shop available	5 (9.1%)	50 (90.9%)*
Would you sell your broiler chicken even though you knew they were recently treated with antimicrobials	13 (23.6%)	42 (76.4%)*
Do you believe/think that broiler chicken with antimicrobial residues may cause a health risk to consumers	15 (27.3%)*	40 (72.7%)

Continued

If you knew that the broiler chicken may contain antimicrobial residue, would you inform the client before selling to him/her	18 (32.7%)*	37 (67.3%)
Is there any importance of delivery of poultry services and dispensing veterinary medicines to farmers and sellers	49 (89.1%)*	6 (10.9%)
Would you recommend use of broiler chicken from recently treated	9 (16.4%)	46 (83.6%)*

*Expected attitude.

Coefficient analysis of the independent variable of age, sex, marital status and business experience was tested using SPSS version 22 software against the dependent variable of attitude, with the correlation factor of P value ≥ 0.05 . This showed similar results as that from the previous dependent variables of knowledge and practices that the age, marital status and education level of the poultry sellers had no significant difference in their attitude on Antimicrobial Use and residues while their business period showed significant difference, meaning that the business period of the poultry sellers affected their responses on attitude regarding antimicrobial uses and residues as shown in **Table 7** below.

Table 7. Coefficients of the variables against attitude.

Variable	t	Sig.
Age	0.693	0.492
Marital status	1.324	0.192
Education level	1.131	0.264
Business period	4.370	0.000

4.5. The Levels of KAP among Poultry Sellers

The data show that 6 (10.9%) of the respondents had a good knowledge level on Antimicrobial use and residues, 34 (61.8%) had a good attitude toward the usage of antimicrobials and 12 (21.2%) of the respondents had good practices on Antimicrobial uses as illustrated in **Figure 2**.

4.6. Correlation between Knowledge against Attitude and Practices

A correlation test between knowledge against attitude and practices was conducted by using Pearson's correlation test. As per the criteria by Cohen (2013), the correlations were ranked as 0 - 0.25 = weak correlation, 0.25 - 0.5 = fair correlation, 0.5 - 0.75 = Good correlation and >0.75 = excellent correlation. Therefore the correlation analysis between knowledge and practices of the poultry sellers revealed a good positive correlation, as indicated by the Pearson coefficient of 0.654. This suggests that as participants' knowledge of Antimicrobial use and residues increases, also their practices tend to improve as indicated in **Figure 3**.

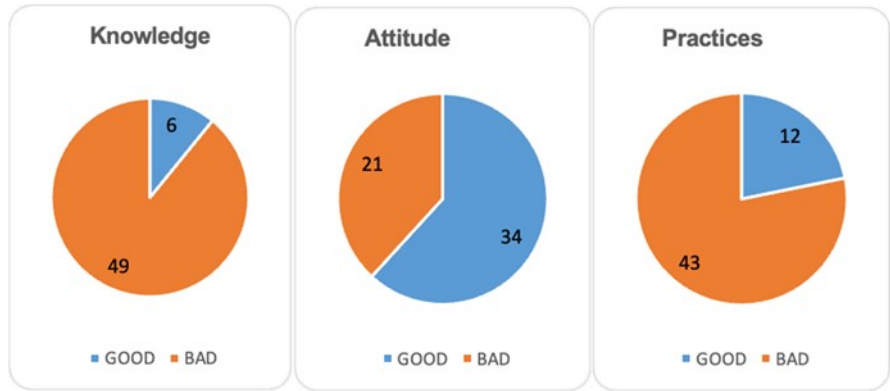


Figure 2. KAP levels of the study group.

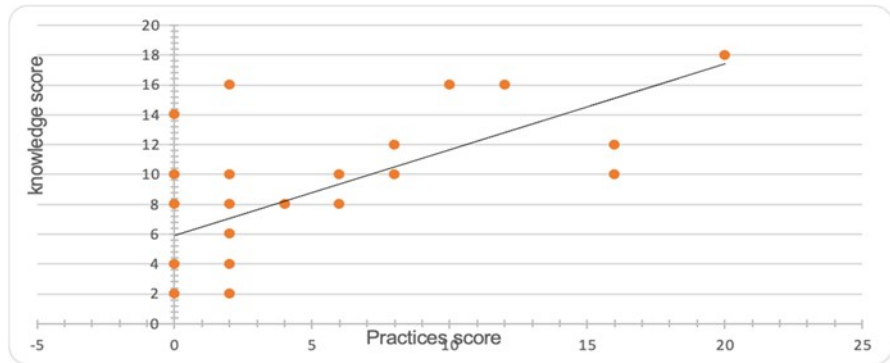


Figure 3. Correlation between knowledge and practices score.

Whereas the correlation analysis between knowledge and attitude score indicated there is no linear relationship between knowledge and attitude among participants in the study, due to the result of a Pearson coefficient of 0.077, this means that the attitude of the poultry sellers towards Antimicrobial use and residues does not increase or decrease with their knowledge as shown in **Figure 4** below.

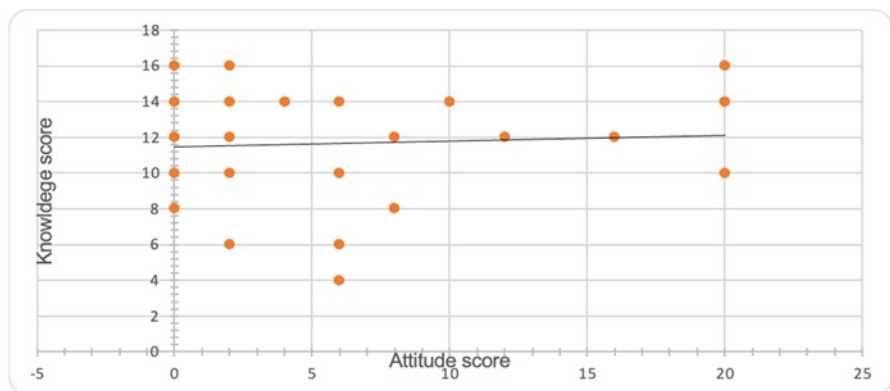


Figure 4. Correlation between knowledge and attitude score.

5. Discussion

Excessive use of antimicrobials in food-producing animals selectively favors

resistant bacteria and increases the risk of AMR in public health [10] likewise the knowledge and behavior of farmers can significantly influence their decision to use antimicrobials [11]. This study assessed the poultry Seller's knowledge, attitude and practices regarding antimicrobial use in Mjini Magharibi district, Zanzibar. The study revealed a low knowledge (89.1%) of antimicrobial use and antimicrobial resistance, good attitude (61.8%), and poor practices (78.2%) towards antimicrobial use and antimicrobial resistance.

The demographic information on poultry sellers revealed that many sellers were young adults belonging to ≤ 35 age group which accounted for 24.5% of all the participants, with all participants being male. This suggests that the poultry business in Zanzibar like many other businesses is male dominated and this can be explained by the Zanzibarians culture, where business-entrepreneurship is largely male-dominated.

The results that 89.1% of the respondents have low knowledge of Antimicrobial Use and Resistance, could be due to the majority of the poultry sellers only having attended primary and secondary levels of education in which animal husbandry is not being taught as such they lack the basic animal husbandry knowledge and skills. as well another study conducted in Cameroon found that a significant proportion of participants lacked a comprehensive knowledge and had a low mean score on antimicrobial use and antimicrobial resistance [12]. This study shows that there is a knowledge gap among most poultry sellers on both AMU and AMR, as seen by the low knowledge scores in the survey. As a result, poultry sellers may utilize antimicrobials inappropriately since they are unaware of the potential negative effects of improper use of these drugs, which can worsen AMR. Therefore, it is necessary to raise awareness among the retail poultry sellers in Zanzibar on proper antimicrobial use and resistance including antimicrobial stewardship programs.

This study revealed that 10.9% of the participants knew what antimicrobial residues are but only 5.5% of the participants were aware of what side effects of antimicrobial residues could be associated with. This may also be due to the low knowledge and education levels of the majority of the sellers who only had either a basic primary or secondary education and the majority who had never attended any formal education. Our findings indicate that tetracycline antibiotic was not known by 76.5% of the participants, but only 23.6% were aware of its use in poultry. Moreover, the withdraw period was seen to be a new concept to many poultry sellers (65.5%) with only 34.6% being familiar with the withdraw period. Correspondingly, majority of the participants (85.5%) were not aware of antimicrobial resistance. These findings further suggest that the poor knowledge levels of the respondents and lack of public health awareness on food safety and hygiene and AMR is a serious challenge unless it is addressed the situation is likely to be worsened. Our study also revealed that 87.3% of the sellers at Mwanakwerekwe and Darajani markets were not aware of tetracycline residues in poultry meat and also do not know if tetracycline residues can cause health consequences to consumers.

This further cements our argument on the low knowledge in this community. There is a need for animal health education as well as food safety and hygiene practices around the market places but also in the general public. Several studies have shown that overuse of antimicrobial residues in food can increase the potential risk of antimicrobial resistance such as that of [7].

The findings that the knowledge level affected practice level further call for immediate and deliberate civic awareness education on the subject of AMU and AMR in Zanzibar. For example our study revealed that 63.6% of the participants agreed to use antimicrobials to treat their broiler chicken, but the majority of them (69.1%) did not follow prescriptions when administering such antimicrobials. As expected 78.2% of those who reported having used antimicrobials to treat the live birds they sell at the market places do not observe a withdrawal period after treating their birds with antimicrobials. This aligned with the results of a study done in Cambodia, where about half of the participants did not well comprehend the withdrawal period when using antimicrobials [13]. These practices could potentially increase the risk to the public health if antimicrobial residues in animal products get into the food supply chain.

However, our study revealed that the majority of the poultry sellers at Mwanakwerekwe and Darajani markets had a good attitude toward antimicrobial use and resistance, where (89.1%) of the participants agreed that it is important to provide farmers and poultry sellers education on good animal husbandry practices, antimicrobial stewardship as well as food safety and hygiene practices. The study also revealed that 83.6% of the sellers still believe and trust the continuation of the use of antimicrobials in broiler chicken as the best alternative to treat poultry diseases. Despite the high attitude score of the participants, 30.9% of participants continue to promote the excessive use of antimicrobials in pursuit of desired outcomes. Furthermore, the present study also concluded that the level of attitude was not influenced by the level of knowledge whereby most individuals had a high attitude although they had poor knowledge regarding antimicrobial use. This could be due to the outcomes and advantages of the antimicrobials on poultry, which mainly include disease and infection prevention and growth promotion.

6. Conclusion

The assessment of poultry sellers' attitudes, knowledge and practices regarding the use of antibiotics and resistance in Zanzibar revealed a critical knowledge gap. Majority of the sellers had low knowledge, and two-thirds exhibited severe ignorance regarding the use of antibiotics and their side effects, with poor practices such as non-adherence to the withdrawal period. This levels up issues related to food safety as well as AMR and AMU, endangering the entire community involved with the consumption of poultry products. These findings emphasize the urgent need for education interventions, such as farmer based schools around farms and markets places which would target improving knowledge levels, attitudes and practices among poultry sellers on the responsible use of antimicrobials, AMR as

well as food safety, these interventions would help to improve and raise awareness so as to mitigate the quickly growing threat of antimicrobial resistance in Zanzibar. Additionally, Antimicrobial stewardship programs and surveillance services from the appropriate authorities should be initiated for farmers and sellers involved with the poultry supply chain to reduce the health risks that may arise.

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Ethical Statement

The study was approved and sought by the ethical committee and given the reference number of ZAHREC/05/ST/AUG/2023/150 from Zanzibar Health Research Institute.

Conflicts of Interest

All authors declare no conflict of interest.

Authors' Contribution

Data collection, analysis, interpretation and writing was done by the principal investigator Rai Ramadhan Ali (MSc. Candidate) whereas drafting and reviewing the article was done by Dr. Abubakar Hoza (Supervisor), Dr. Alexandra Mzula (Supervisor) and Dr. Othman Juma (Supervisor).

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